


# CP/AM<sup>TM</sup> 5.1

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## User's Manual

 **APPLIED ENGINEERING<sup>TM</sup>**

A DIVISION OF AE RESEARCH CORPORATION

**v1.21**

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# **CP/AM<sup>TM</sup> 5.1**

## **User's Guide**



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## Preface

Welcome to the world of CP/M®! The CP/AM 5.1™ operating system and the Z-80™ microprocessor on your Applied Engineering® Z-80 Plus™, Z-Ram™, or Z-80c™ will enable you to run thousands of CP/M based programs on your Apple computer. This manual will introduce you to CP/AM 5.1, Applied Engineering's version of the CP/M operating system.

**About This Manual** This manual is not a manual for professional programmers, nor is it a tutorial for learning the CP/M operating system. The intent of this guide is to provide you with enough information about the CP/AM operating system to enable you to run your CP/M based application programs, configure the operating system to suit the requirements of your system, and manipulate CP/M files, using the utilities provided on the CP/AM 5.1 System Master disk. Here's a summary of what is contained in this manual:

- Chapter 1    **An Introduction to CP/AM**, gives you an overview of the CP/AM 5.1 operating system and explains some of the basic CP/M conventions and commands.
- Chapter 2    **CP/AM Transient Commands**, explains how to use some of the utility resources included on the CP/AM 5.1 System Master disk to create and manipulate CP/M disks and files.
- Chapter 3    **CP/AM System Configuration**, tells you how to customize the CP/AM operating system on your disks to suit your needs and the configuration of your computer system.
- Chapter 4    **CP/AM Technical Reference**, is intended for hard-core CP/M hackers only. All others please stay away!
- Appendix A    **Apple® IIGS Users**, informs IIGS owners what steps particular to the IIGS should be taken to make the GS to work with CP/AM.
- Appendix B    **Wordstar and CP/AM**, tells you what you need to do before running the CP/M based Wordstar word processor program.
- Appendix C    **Sider™ Hard Disk Support**, gives instructions for installing and using CP/AM 5.1 on First Class Peripheral's Sider hard disk drive.
- Appendix D    **Further Reading**, suggests books about CP/M, Wordstar and the Z-80 card that you may find helpful.

## *Preface*

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- The model and configuration of your computer (what peripherals are being used).
- If the question is related to an Applied Engineering memory expansion card, please provide the revision level, original memory configuration, and current memory configuration of the card.
- The name, version, and revision level of the software with which you are experiencing problems.
- The results of any test programs or diagnostics that you may have run.
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### An Introduction to CP/AM

**About CP/AM 5.1** CP/M, which stands for Control Program / Monitor, is a very popular operating system designed for computers which use the Z-80 microprocessor. Your Apple computer is based on a 6502 microprocessor, which is why you have installed Applied Engineering's Z-80 based co-processor card. CP/AM 5.1 is Applied Engineering's version of CP/M and is the disk operating system which allows programs written for CP/M to run on the Z-80 equipped Apple computer.

**Operating System?** Your computer is not just a single unit, but several components, all of which must work together as a system. A typical computer system consists of a CPU (central processing unit), peripheral input/output devices (video monitor, keyboard, disk drives, printer), and two equally important components: the application program and the operating system. The function of the application program depends on the purpose for which it was written. (e.g. word processor, spreadsheet, etc.) The primary function of an operating system is to interface the application program (software) with the CPU and its peripheral devices (hardware) and to manage the flow of information within the computer. The operating system is actually a set of standardized programs, called subroutines, which are loaded into a reserved portion of the computer's memory whenever a system disk is booted. These subroutines contain the instructions called upon by the application program to manage and coordinate the computer system's routine input and output activities.

Programs written for Digital Research CP/M version 2.2, as well as virtually all older CP/M programs, will run under CP/AM 5.1. CP/AM 5.1 supersedes CP/AM 4.0B, the previous version of the operating system. Version 5.1 is completely backward compatible with and has all of the many features of CP/AM 4.0B, but has the following improvements:

- Full support for peripheral devices which use Apple Computer's Protocol Converter. This enables you to create bootable devices on the UniDisk 3.5™, RamFactor™, Apple II Memory Expansion Card, as well as future devices which support the Protocol Converter.
- Improved video screen drivers, which use the computer's video hardware rather than program software to send output to the video display. This allows faster scrolling and compatibility with Franklin Ace 2000 series video displays.
- Full support for First Class Peripheral's Sider hard disk drive. Installation utilities are provided on the CP/AM 5.1 System Master.

# Introduction to CP/AM

## Chapter 1

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### System Requirements

Hardware: CP/AM 5.1 was designed for use with the following Applied Engineering Z-80 products:

Z-80 Plus	Apple IIGS, //e, II, II +, Franklin Ace, and Laser 128 (Apple IIGS users refer to Appendix A.)
Z-Ram Ultra 3	Apple //c
Z-Ram II	Apple //c
Z-Ram	Apple //c
Z-80c	Apple //c

Memory Size: CP/AM 5.1 requires a minimum of 64K of Random Access Memory (RAM). If the CP/AM operating system is to be run on an Apple II, II+ or Franklin Ace 1000 series computer which has less than 64K of memory, the 44K version of CP/AM 4.0B must be used. This version and its utilities are supplied on the back side of the CP/AM 5.1 System Master disk. The differences between versions 4.0B and 5.1 are covered in Chapter 3.

Video Display: Your computer must be capable of displaying an 80 column screen. You should have an 80 column text card installed in the auxiliary slot of an Apple //e or in slot 3 of an Apple II, II+ or Franklin Ace 1000 series computer. The Apple IIGS and //c, Laser 128, and Franklin Ace 2000 series computers have built-in 80 column text cards. Obviously, a video monitor capable of 80 column display is also required. Most monochromatic video monitors are capable of 80 column display. Most TV sets, on the other hand, are not. Televisions are only acceptable for programs which use a 40 column display. The narrower 80 column characters tend to blur and are very difficult to read when displayed on a TV screen. CP/AM also supports RGB interfaces and monitors.

Mass Storage CP/AM 5.1 supports both the standard 5 1/4 inch floppy disks and the new 3.5 inch microfloppy disks (UniDisks). Your computer system should have at least one 5 1/4 inch floppy disk drive. The floppy disk interface card must be in slot 6. The disk format, or method in which data is stored on the mass storage medium (usually floppy disk), varies from one brand of computer to another. Disks containing CP/M programs must be in Apple disk format. While most programs written for the CP/M operating system are usually compatible with CP/M used on different brands of computers, the program files must first be converted to the appropriate disk format. When selecting CP/M programs, make sure that the disks are in Apple compatible format. Some dealers or CP/M oriented users groups may have the facilities to convert programs stored on various media or in different format to a compatible Apple format.



# Introduction to CP/AM

## Chapter 1

### Before You Begin...

Whatever can go wrong, will go wrong! Make a BACKUP copy of the CP/AM 5.1 System Master disk. This is not only a good idea, it is required. Some CP/AM commands require the floppy disk be write-enabled. (The CP/AM 5.1 System Master has no write-enable notch.) Use the following procedure to make the copy:

Boot the CP/AM 5.1 System Master disk. This message should appear on the screen:

```
APPLE ][ CP/AM
60K Ver 5.1
(C) 1986 APPLIED ENGINEERING
```

```
A>
```

At this prompt (A>), type the following command if you have a two-drive system:

```
COPY B:=A:
```

If you have a one-drive system type:

```
COPY A:=A:
```

The directions, displayed on the screen, will prompt you to insert a SOURCE disk, which is the original CP/AM 5.1 System Master disk, and a DESTINATION disk, which is any blank disk with the write-protect tab removed. For a one-drive copy it will be necessary to alternately insert the SOURCE and DESTINATION disks until the disk is completely copied. Store the original CP/AM 5.1 System Master disk in a safe place.

### CP/AM 5.1 Conventions

The following is a review of the standard CP/M command and file conventions as well as some special notes about CP/AM command syntax used in this chapter. In the command examples shown in this text, a carriage return is shown as "<cr>". Control characters are indicated by preceding the command character with a "^" (circumflex). The system prompt, "A>", shown at the beginning of the command line examples in this manual, is not part of the command.

In a command expression (command line), a space is used to separate the command from its argument. The space is critical to the execution of the command sequence.

CP/AM will accept lower case characters entered from the keyboard. For instance, a control-c has the same effect as a control-C. Filenames and filetype extensions entered in lower case are converted to upper case in the disk directory.

**WARNING:** Don't press CONTROL-RESET while your CP/M program is running! Doing so will cause the computer to reboot!

### File Names

CP/AM file names follow the standard CP/M format. A file name can have from one to eight printable ASCII characters, except for the ones shown below. (ASCII{a'skee} stands for American Standard Code for Information Interchange.)

< > . , ; : ? [ ] \* =



# Introduction to CP/AM

## Chapter 1

---

### File Extensions

CP/AM file name extensions also follow the CP/M standard. An extension can have from one to three printable ASCII characters and cannot contain any of the "disallowed" characters. The extension is separated from the end of the file name by a period. For example:

**filename.ext**

Since CP/M programs use the file extension to identify the file type, you should use the following extensions for their intended purpose only.

<b>.ASM</b>	Assembly language source file.
<b>.MAC</b>	Assembly language macro file.
<b>.HEX</b>	Hex format source code file.
<b>.REL</b>	Relocatable machine language file.
<b>.COM</b>	Transient command program file.
<b>.PRN</b>	Print file. (Assembly language listing.)
<b>.LIB</b>	Library file.
<b>.SUB</b>	Command list for SUBMIT execution.
<b>.C</b>	C language source code.
<b>.BAS</b>	BASIC source code file.
<b>.PAS</b>	Pascal source code file.
<b>.COB</b>	COBOL source code file.
<b>.FTN</b>	FORTRAN source code file.
<b>.TXT</b>	Text file.
<b>.DOC</b>	Documentation file.
<b>\$\$\$</b>	Temporary file.

### Filename "Wildcards"

A Wildcard character is a symbol which represents a character or a string of characters in either a filename or extension. CP/M uses two such wildcards, the question mark ( ? ) and the asterisk ( \* ). The asterisk is used to represent either the entire filename , extension, or a trailing character string of a filename or extension. The question mark represents only a single character in either string. The following examples illustrate the uses of wildcards.

**DIR A:MISC.\***

This command displays a directory listing of all files on Drive A that have a filename of MISC, regardless of the extension.

**DIR \*.COM**

This will return a listing of all Drive A files which have an extension of ".COM". The drive in this example is the default drive.

**DIR B:S\*.COM**

This example will return a listing of all Drive B files with filenames beginning "S" and an extension of ".COM".

# Introduction to CP/AM

## Chapter 1

### DIR A:????.DOC

Since the question mark represents only one character in the string, this command will return a listing of files having an extension of ".DOC" and filenames containing any four (or fewer) characters.

#### Disk Drive Specifier

When a command is used without a drive specifier, the default drive will be assumed for the operation. The default drive is indicated at the CP/AM system prompt by the letter immediately to the left of the caret (>). When the CP/AM system is first booted, the "A>" prompt is displayed. This informs the user that drive A is the default drive and the operating system is ready for a command.

To change the default drive, type the desired drive letter followed by a colon and a carriage return. For example, to change the default drive from A to B, you would use the following command:

```
A>B:<cr>
B>
```

The B> prompt indicates drive B: is now assigned as the current drive.

Note: CP/AM stores information about the current disk in memory. CP/M is not like some other operating systems; you cannot change disks without informing the operating system. To let CP/AM know that you have replaced the original, type a control-C at the CP/AM prompt. This is called "logging in" a new disk.

#### Logical Devices

The CP/AM operating system supports the following standard CP/M input and output devices:

CON:	Console device	Keyboard and video display (input/output)
LST:	List device (printer)	Slot 1 interface (output)
RDR:	Reader device	Slot 2 interface (input)
PUN:	Punch device	Slot 2 interface (output)

#### Resident System Commands

There are two types of CP/AM commands, resident commands and transient commands. The resident commands, consisting of system commands and line editing commands, are built into the operating system. The transient commands are actually utility programs stored on disk. Transient commands are covered in the next chapter.

There are seven system commands: DIR, ERA, REN, TYPE, PAGE, USER, and SAVE. These commands are summarized in the following pages and include examples of valid command expressions.



# Introduction to CP/AM

## Chapter 1

---

### DIR

Display Directory

- DIR<cr>** Displays a directory of the files on the default drive.
- DIR B:<cr>** Displays the contents of drive B. Drive A remains the default drive.
- B:DIR<cr>** Reassigns the default drive to drive B and displays its directory.

### ERA

Erase a File

- ERA B:ABCD.BAS<cr>**  
Erases the file on drive B with a filename of ABCD and an extension of .BAS. Under CP/AM, the drive specifier is mandatory.
- ERA A:\*.BAS<cr>**  
Erases all the files on drive A with the extension, .BAS.
- ERA A:\*. \* A:\*. \*<cr>**  
Using the asterisk wildcard in this manner erases all files on drive A. To prevent accidental disk erasure, the drive specifier and wildcards must be entered twice, as shown.

### REN

Rename a File

- REN NEWNAME.BAS=OLDNAME.BAS<cr>**  
Changes the file named OLDNAME.BAS to NEWNAME.BAS

### TYPE

Display an ASCII file on the screen

- TYPE ABCD.TXT<cr>**  
Displays the ASCII text file named ABCD.TXT on the monitor. The listing of the display can be paused at any time by entering a Control-S (^S), and resumed by pressing any key or another ^S. Pressing ^C (or any key other than ^S) while the file is scrolling will abort the listing. See PAGE command.

### PAGE

Set number of lines for TYPE command

- PAGE 60<cr>**  
Causes the TYPE command to pause scrolling after displaying 60 lines. The normal (default) setting is PAGE 0 (continuous scrolling). Any value between 0 and 255 is permitted. A setting of PAGE 23 is recommended for display to the monitor.



# Introduction to CP/AM

## *Chapter 1*

### USER

Specify the current user

**USER 7<cr>**

Reassigns the user designation from the default of User 0 (or previous user) to User 7. A disk has fifteen possible user areas, 0 through 15, which are logically separate from one another. The current user is indicated in the command prompt by the number to the left of the current drive indicator. No number shown indicates User 0. User 7, as in this example, would display this prompt:

**7A>**

User 0, the default when the operating system is booted, is "public" to all other users. For instance, User 5 has automatic access to the files in the User 0 area. If the file specified is not found in the current user area, a search for the file will be made in User 0 area. User 0 does not have direct access to files in other user areas.

### SAVE

Save memory to disk

The SAVE command causes the contents of the Transient Program Area (TPA) of memory to be saved to a file on disk. This command is useful to assembly language programmers, but not to most commercial CP/M software users. The format for this command is:

**SAVE n filename.typ**

where 'n' is the number of 256 byte pages of memory, starting at address 100Hex, to be saved to disk. The following example will save 2048 bytes of the system memory to the file MEMSAVE.XXX.

**A>SAVE 8 MEMSAVE.XXX**

--continued next page--


# Introduction to CP/AM

## Chapter 1

---

### Line Editing Commands

These commands provide some control over the screen display and allow you to correct typing errors. Some commands can be entered by pressing a single key on the keyboard; others require the control key and another to be pressed at the same time. The line editing commands are summarized below.

^M	Terminate the command line.
<cr>	
^J	
^X	Cancel and erase the command line.
^U	Cancel the command line. (Does not erase the command line.)
^H	Cancel and erase last character of the command line.
Delete	(backspace function)
left arrow	
^E	Continue typing the command line on the next line of the screen.
^R	Repeat the current command line.
^S	Pause (and resume) the display scrolling.
^P	Send output (or cancel output) to printer. (LST: device)
^C	Interrupt the current transient program, perform "warm start," and log in a new disk. Do not confuse warm start with warm boot (Control-  -Reset.)

### What's Next...

This chapter has introduced you to the CP/AM operating system and its built-in commands. The next chapter will explain the additional *Transient Commands* provided on the CP/AM 5.1 System Master disk.

### CP/AM Transient Commands

#### About Transient Commands

The routines for the resident commands discussed in the previous chapter are always in memory. CP/AM transient commands are not built-into the operating system; they are conveniently stored on disk until they are needed. This allows great versatility, since they can be deleted if not needed or copied to or from another disk as required.

Transient command files are identified with a type extension of '.COM'. Transient commands are also referred to as "transient programs," or, simply as "programs." When any command is issued to the operating system, CP/AM evaluates it. If it is not a valid system command, the operating system automatically checks the current directory for a transient (.COM) file with a filename matching the the command specified.

If a transient command is specified on drive B; and the command file is not found, the operating system will automatically search for the file on the A: drive. If found, the command will be executed and return to the current drive upon completion. Only drive A: is "public" to the B: drive. All other drives are independent devices.

It is not necessary to enter the filetype extension when executing a transient command. For instance:

```
A>MEGDRIVE<cr>
```

Not all of the transient commands on the CP/AM 5.1 System Master disk are explained in this chapter. Some commands have specific applications and are explained later in this manual. The transient commands covered in this chapter are:

FORMAT	MEGDRIVE
FMTUNI	AUTORUN
COPY	AUTOPC
RESTOR	SUBMIT
PIP	RAMBOOT
STAT	

#### Public Domain Utilities:

NSWEEP	TED
SD	



# Transient Commands

## Chapter 2

---

**FORMAT** Erase and format a blank CP/AM disk.

Before information can be stored on a disk, the disk must be formatted, or prepared to receive that information. This utility allows you to erase all previous data on the disk and format it using the CP/AM format. There are no command expressions for this command. You need only type the command, **FORMAT**, and specify the proper disk drive when prompted. A typical **FORMAT** session, using a two drive system, is shown below.

**A>FORMAT<cr>**

**CP/AM FORMAT VER. 1.1  
(C) 1985 & 1986 BY APPLIED ENGINEERING**

**FORMAT DISK IN WHICH DISK DRIVE --> B**

**INSERT DISK TO BE FORMATTED AND HIT ANY KEY.  
<space bar>**

**FORMATTING...**

**DO YOU WISH TO REPEAT THIS OPERATION? N**

If you had selected the drive A as your formatting drive, you should have removed the disk containing the CP/AM system and replaced it with the disk to be formatted. When **FORMAT** terminates, it returns to the CP/AM operating system. Before you type 'N' at the final prompt, reinsert the disk containing the CP/AM operating system into the current drive.

A non-system disk formatted under CP/AM can store 138K of data. A system disk, one that has the CP/AM 5.1 operating system on disk tracks 0, 1, and 2, has a data storage capacity of 126K. **FORMAT** does not install the operating system on the formatted disk.

**FMTUNI** Erase and format a UniDisk 3.5

This is the utility used specifically to format 3.5 inch UniDisks in CP/M format. If the boot drive ( A: ) is a 5 1/4 inch floppy disk, the operating system in memory must first be configured with the PC.COM utility to recognize the UniDisk interface. Refer to the section entitled *Creating a UniDisk 3.5 System Disk* (Chapter 3) for more details.

To format a UniDisk, simply enter the **FMTUNI** command, as shown in the example at the top of the next page. In this example, the A: drive is a standard floppy disk; drive C: is the UniDisk. The program automatically finds the first UniDisk drive in the system.

A>FMTUNI<cr>

CP/AM Formatter for DISK 3.5 - V1.0

Insert disk to be formatted in drive C:

enter 'Y' to continue, any other to quit:Y

A formatted UniDisk 3.5 can store 776K of data.

### COPY

Copy an entire 5 1/4 inch disk.

COPY will duplicate an entire disk, including the CP/AM operating system tracks. COPY will duplicate only standard 5 1/4 inch floppy disks; it will not copy a 3.5 inch disk. COPY can be used to copy only the CP/AM 5.1 operating system to a disk already containing CP/M programs.

A>COPY<cr>

CP/AM COPY VER. 1.1

(C) 1985 & 1986 APPLIED ENGINEERING

\*B:=A:<cr>

INSERT SOURCE      DISK IN A:

INSERT DESTINATION DISK IN B:

PRESS RETURN TO CONTINUE

<cr>

COPYING...

DO YOU WISH TO REPEAT THIS OPERATION? N<cr>

\*^C

A>

In this example COPY session, notice the COPY command, entered without an argument, returns the asterisk prompt. At this point, the Destination drive = Source drive argument is entered, which is followed by the "insert source/destination disk" dialog. You could then replace the disk in the source drive with the one to be copied and place a blank disk in the destination drive. COPY formats the destination disk before copying the source disk. To exit the COPY utility and return to the CP/AM prompt, type Control-C (^C) at the asterisk prompt.



## Transient Commands

### Chapter 2

---

The next example session illustrates the use of an argument following the COPY command. If the source and destination drives had not been the same, COPY would have displayed the dialog screen shown in the first example. Entering 'N' at the "...REPEAT THIS OPERATION?" prompt would end COPY and return to the CP/AM system in drive A.

```
A>COPY A:=A:<cr>
```

```
CP/AM COPY VER. 1.1
```

```
(C) 1985 & 1986 APPLIED ENGINEERING
```

```
INSERT SOURCE      DISK IN A: AND PRESS RETURN<cr>
INSERT DESTINATION DISK IN A: AND PRESS RETURN<cr>
INSERT SOURCE      DISK IN A: AND PRESS RETURN<cr>
INSERT DESTINATION DISK IN A: AND PRESS RETURN<cr>
INSERT SOURCE      DISK IN A: AND PRESS RETURN<cr>
INSERT DESTINATION DISK IN A: AND PRESS RETURN<cr>
INSERT SOURCE      DISK IN A: AND PRESS RETURN<cr>
INSERT DESTINATION DISK IN A: AND PRESS RETURN<cr>
INSERT SOURCE      DISK IN A: AND PRESS RETURN<cr>
INSERT DESTINATION DISK IN A: AND PRESS RETURN<cr>
```

```
DO YOU WISH TO REPEAT THIS OPERATION? N<cr>
```

The following example shows how to copy *only the CP/AM 5.1 operating system* from a source disk to a destination disk.

```
A>COPY B:=A:/S<cr>
```

This will copy only the operating system from drive A to tracks 0, 1, and 2 of drive B. Install the CP/AM 5.1 operating system only on a backup copy of your original CP/M program disk.

#### RESTOR

Restore a previously ERAsed file.

If a file or files have been accidentally erased and nothing has been subsequently written to the disk, this utility can be used to recover the file(s). The format for this command is:

```
A>RESTOR d:oopsname.typ<cr>
```

The drive specifier (d:) is required only if the erased file does not reside on the current drive. The filename represented by "oopsname.typ" is the name of the erased file. After the file is restored, it should be checked for possible damage and repaired.



### PIP

#### File copy utility

PIP (an acronym for Peripheral Interchange Program) will allow you to copy CP/M files from one device to another. PIP can be used to manipulate and transfer files from an input device, usually a disk drive, to an output device—another disk, a printer, or the video display.

PIP is executed by typing 'PIP' at the command prompt as shown below.

```
A>PIP<cr>  
*
```

The asterisk prompt, which is then displayed below the command line, is the PIP console mode prompt and indicates the program is ready to accept a PIP command argument. The format for the command argument is:

**x:newname.typ=y:oldname.typ**

This expression will copy the existing file oldname.typ on drive y, to a newly created file, named newname.typ, on drive x. The filename represented by 'newname' is not required to have the same name as its original.

```
*B:WHATSUP.DOC=A:SAMPLE.DOC<cr>  
*
```

Here, PIP would copy 'SAMPLE.DOC' from drive A to the new file named 'WHATSUP.DOC' on drive B. After PIP has completed the copy, it displays the asterisk, prompting the next command expression. If only a carriage return is pressed at the asterisk prompt, PIP will stop, returning to the CP/AM command prompt.

```
A>PIP B:=A:STAT.COM<cr>  
A>
```

In this example, the PIP command and a PIP command argument are entered in the same system command line. Notice there is no 'newname.typ' specified. The 'oldname.typ' of 'STAT.COM' is used as the default name for the new file on drive B. When executed from the system prompt, PIP returns to the system prompt upon completion.

```
A>PIP B:=A:*. *<cr>
```

Using the asterisk wildcard, all files will be copied from drive A to drive B. This will copy only files; not the CP/AM system.

### Concatenating text files

PIP can also be used to concatenate (merge) two or more ASCII text files. (ASCII: American Standard Code for Information Interchange) The next example demonstrates a sample concatenation expression. The multiple source text filenames must be separated by commas.

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**A>PIP B:BIGFILE.TXT=A:FILEA.DOC,FILEB.DOC,TEMP.TXT<cr>**

First, the contents of the FILEA.DOC will be copied to the new file, BIGFILE.TXT, on the B: drive. Next, the contents of text file, FILEB.DOC will be appended to BIGFILE.TXT, followed by TEMP.TXT.

### Comparing files

One of PIP's many useful features is its ability to compare the contents of two files. This feature is implemented by separating the destination from the source with a double colon. (x:dest.typ::y:source.typ). The drive specifiers (A and C in the example below) are not required if the files are located on the same disk.

**A>PIP A:NSWEEP.DOC::C:NSWP.TXT<cr>**

The contents of both files will be read and compared, byte for byte. PIP responds with either "Files are identical" or "Files MISMATCH."

### Sending Output to Console or Printer

PIP will also send text file output from a disk device to a non-disk device. LST: is the logical device name for the slot 1 output device —usually a printer interface. PUN: is the slot 2 output device and CON: is the video display's device name.

**A>PIP CON:=NSWEEP.DOC<cr>**

This will send the contents of the text file, NSWEEP.DOC to the video screen. (Try it; NSWEEP.DOC is on the System Master.)

In the next example, the contents of the same text file is sent to the printer.

**A>PIP LST:=NSWEEP.DOC<cr>**

To pause output to the LST: or CON: devices, enter a control-S from the keyboard; press any key to continue. To abort, enter a control-C.

### Input from Console

By specifying a disk device and filename as the destination, and the console (CON:) as the source device, you can create a text file directly from the keyboard.

Input from the CON: device puts PIP in the line insertion mode, indicated by the hyphen prompt. Text is entered a line at a time, each line followed by a carriage return. The last line must contain only the file's End-Of-File (EOF) mark, a control-Z, followed by a carriage return.



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```
A>PIP B:SAMPLE.TXT=CON:<cr>
-The quick brown fox<cr>
-jumps over<cr>
-the lazy dogs.<cr>
-^Z<cr>
```

A>

In this example, PIP has created the text file, SAMPLE.TXT, containing the text entered from the keyboard. This feature is very useful for creating a SUBMIT execution file.

If LST: is named as the destination device, output will be sent from the keyboard to the printer, as illustrated below.

```
A>PIP LST:=CON:<cr>
-How now<cr>
-brown<cr>
-cow?<cr>
-^Z<cr>
```

A>

### Special PIP Devices

Additional source devices are provided by the PIP command program. These are specialized devices with specific applications.

**PRN:** This is the same as the LST: device, only different. In the destination file, tab spaces are set to every eighth character position, form feeds are inserted every 60 lines, and each line of text is numbered. This is equivalent to the LST: device used with PIP parameter [NP60T8]. PIP parameters are explained in the next section.

**NUL:** This output device sends out 40 ASCII null characters. It's real handy if you want to concatenate a 4 inch blank leader and trailer on your paper tape.

**EOF:** Output device which sends an EOF (^Z) mark to the destination device. This is rarely used in disk to disk transfers; PIP automatically inserts the EOF mark at the end of each file.

### PIP Parameters

During the PIP file transfer from one device to another, special parameters can be used to affect the file being transferred. These parameters can be invoked by appending the PIP command line with parameter code letters enclosed by square brackets. For example:

```
A>PIP B:*.TXT=A:*.TXT[CEV]<cr>
```



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The following is a description of each of the valid parameters. These are not "toggle" parameters. They are only valid during the execution of the current command expression.

### A Attribute archive mode

This parameter sets the PIP archive mode. Only the specified source files with their archive attributes reset to zero will be copied to the destination. Once the source file has been copied, the archive attribute in the source file directory is set to indicate that the file has been archived.

Note: STAT.COM or NSWEEP.COM can be used to set or reset the archive attribute.

One very useful application of the archive mode is "backing-up" (archiving) a larger disk onto several floppy disks. If one of the floppy disks becomes full, the file being transferred at the time is closed and renamed to indicate that it is only a partial file. The current floppy disk is logged out and PIP displays a prompt for another formatted floppy disk. The remainder of the partial file is copied and this process continues until all specified files are archived.

For example, if the file, AEDATA.TXT, is being copied, PIP will close the destination file when the destination disk becomes full and name it AEDAT#01.TXT. The next segment of this file will be closed as AEDAT#02.TXT. If this same file was large enough to span another floppy volume, it would be closed as AEDAT#03.TXT on the next disk. Reloading segmented archive files is accomplished with the [Rn] parameter.

### B Archive all mode

This parameter does not set the PIP archive mode, but must be used in combination with the [A] parameter (i.e. [AB]). All specified files are copied regardless of the state of their attribute flag. Functionally, this parameter is the same as the [A] parameter.

### C Console confirmation prompt

PIP will pause after each file copied and display a prompt similar to this:

```
COPYING:
A:SD.DQC   Copy this file? (Y/N):
```

Enter Y for Yes, N for no. Lower case is accepted. You will be prompted in this manner for each file to be copied.

### Dx-y Delete columns

Only ASCII text files are affected by the [Dx-y] parameter. From each line of text transferred, PIP will extract and copy only the characters between and including the column positions indicated by the numeric variables, x and y. The variables must be separated by a hyphen. The x variable is the beginning column position; y is the

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ending position. If only one value is entered, all characters past the value indicated are deleted during transfer to the destination.

### E Echo to console

You should use the [E] parameter only when transferring ASCII text files. The contents of text files will scroll past on the console display as they are being copied.

### F Filter form feeds

All form feeds, sometimes called page ejects, will be removed as it is being copied to the destination. When used with the [Px-y] parameter to insert page ejects, form feeds are filtered from the text before the page ejects are inserted.

### I s Ignore all past mask character string s

PIP will omit, from the text file being transferred, all characters beginning with and including the mask character string to the end of the current line. The end of line is marked by a carriage return followed by a line feed. (cr,lf) The carriage return and line feed are also removed.

The mask character string, represented by s, is any alphanumeric character string ending in a control-Z. IMPORTANT: This comparison string MUST end with a control-Z! Before executing the transfer, PIP will display the message:

Ignore "(s string)" through cr,lf. OK? (Y/N):

### J Prompt for source and destination disks

This parameter is most useful for computer systems with only one disk drive. You will be alternately prompted to insert the source and destination disks until the specified files have been copied. As an example:

A>PIP A:=A:CPAM60F.COM[J]<cr>

Install S O U R C E disk, then press cr (or Q to quit):<cr>

Install destination disk, then press cr (or Q to quit):<cr>

Upon completion PIP will attempt to return to the warm boot back to the current disk. Make sure the destination disk has a bootable operating system also.

### L Translate upper case to lower case

All upper case characters encountered in the source text file will be converted to lower case characters in the destination file.



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**N** Add line numbers

Sequential line numbers, each followed by a colon and a space, will be added to the beginning of each line of a destination text file. Line numbers start at 1.

**O** Disable line editing during object code file transfer

This parameter is used for the transfer of non-ASCII files only. It will cause PIP to ignore any control-Z encountered in the transfer of a non-ASCII (object code) file.

Normally, when PIP encounters a control-Z during an ASCII text file transfer, it interprets it as an end-of-file mark and terminates the transfer. Unfortunately, a control-Z imbedded in a non-ASCII file will also end the transfer —unless the file type is .COM. Although .COM files are non-ASCII files, PIP assumes that a file with this extension is not an ASCII file and automatically ignores any control-Z characters.

**Px-y** Print x lines, starting at page y

When sending ASCII text file output to the LST: device (printer), PIP normally does not insert form feed commands. The numeric variable, x, determines the interval number of lines printed before a form feed character is sent to the LST: device (lines per page). The y variable is optional and tells PIP to start printing y number of pages from the beginning of the file. The variables must be separated by a hyphen.

PIP does not insert form feed characters when copying text files to another disk device or the CON: device.

**Qs** Quit copy at mask character string s

*This parameter can only be invoked from the PIP console mode.*

PIP will terminate the text file copy when the character string s is first encountered. The characters matching the mask string will not be copied.

The mask character string, represented by s, is any alphanumeric character string ending in a control-Z. **IMPORTANT: This string MUST end with a control-Z!**

**Rn** Reload segmented archival files

This parameter is used when reloading files which were archived under the [A] or [AB] PIP parameters. The variable, n, indicates the number of archived file segments to be restored. For example, to reload the files archived in the example given for the [A] parameter:

```
A>A:AEDATA.TXT=B:AEDAT*.TXT[R2]<cr>
```



Notice the asterisk wildcard character is used to select any file beginning with AEDAT# and ending with an extension of .TXT. In this case, the two archive file segments created by PIP were AEDAT#01.TXT and ADAT#02.TXT. The n value of 2 in this example tells PIP that two file segments are to be concatenated to form the file AEDATA.TXT.

**S s** Start copying at mask character string s

*This parameter can only be invoked from the PIP console mode.*

PIP will begin copying a specified text file when the character string s is first encountered. The characters matching the mask string will also be copied.

The mask character string, represented by s, is any alphanumeric character string ending in a control-Z. IMPORTANT: *This string MUST end with a control-Z!*

**Tn** Set tab spaces

Tab spaces will be set at each column position interval specified by the variable n.

**U** Translate lower case to upper case

All lower case characters encountered in the source text file will be converted to upper case characters in the destination file.

**V** Verify file copy

This parameter will cause PIP to verify each destination file against its corresponding source file after it has been copied.

**Z** Zap (clear) parity bit

PIP will clear the parity (high order) bit of each character copied to the destination text file.

**STAT**

Status

STAT provides the user with information about one or more files or disks. The information returned by STAT depends on the various arguments which can be used with the STAT command.

STAT comes with its own built in help screen. As a reminder, whenever STAT is invoked, the first line displayed is "Type STAT ? for Help."

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#### STAT Help Screen:

Display logged disks & space available:

STAT

Display space available on d:

STAT d:

Display file size and attributes:

STAT d:afn

Display users on d: & their disk space:

STAT d:\*. \* U:

Set file attributes:

STAT d:ufn \$<R/O,R/W,SYS,DIR>

Alternative set of clear file attributes:

STAT d:ufn \$<S,C><F<1-8>,T<1-3>>

Clear all file attributes:

STAT d:ufn \$ALL

Write protect drive:

STAT d: \$R/O

Set the iobyte:

STAT <LST,PUN,RDR,CON> T:<0,1,2,3>

Display the iobyte:

STAT x T:

Display disk size & characteristics:

STAT x S:

#### Disk and file status

Several different STAT command line arguments can be used to provide a variety of information about the disks and files logged in the system.

```
A>STAT<cr>
```

```
Type STAT ? for Help
```

```
A: R/W, Space: 12K
```

In this example, only the STAT command was issued, returning the disk access status (R/W) and the amount of useable space left on drive A. If drive B, or any other drive, had been accessed since the last warm start or cold boot, STAT would also return the status of that drive. R/W indicates that the drive is both read and write enabled.

```
A>STAT B:<cr>
```

```
Type STAT ? for Help
```

```
B: R/W, Space: 112K
```

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The drive specifier argument following the STAT command will cause STAT to return only the status of the drive specified.

```
A>STAT B:STAT.COM<cr>
Type STAT ? for Help
```

Recs	Bytes	Pex	Acc	
35	5k	1	R/W	B: STAT .COM
B: R/W Space: 112K				

By specifying a specific (unambiguous) filename, STAT will provide information about that file. The drive specification is optional. In this case, STAT has returned information about the STAT.COM file on drive B. The Recs (records) column shows the number of 128k byte records in the file and the Bytes column indicates the number of bytes in the file. If Bytes divided by Recs doesn't equal eight, don't be alarmed — close counts. The number of 16K extents (file pieces) in the specified file is indicated in the Pex column. The Acc column shows the file access attribute status of the file — either R/W or R/O.

```
A>STAT B:*. *<cr>
Type STAT ? for Help
```

Recs	Bytes	Pex	Acc	
30	4k	1	R/W	B: COPY .COM
30	4k	1	R/W	B: FORMAT .COM
18	3k	1	R/W	B: MEGDRIVE .COM
35	5k	1	R/W	B: MYFILE .DOC
96	12k	1	R/W	B: cp/am .sys
B: R/W Space: 122K				

This example illustrates a variation of the preceding example, using the asterisk (ambiguous filename) wildcard to select all files on drive B. The last file shown in the list is the file containing the CP/AM operating system.

The following STAT command expression will provide general information about a specific disk drive.

```
A>STAT B: S:<cr>
Type STAT ? for Help
```

B: Drive characteristics

1120:	128-byte record capacity
140:	kilobyte drive capacity
48:	32-byte directory entries
12:	checked directory sectors
128:	records/ physical extent
8:	records/ reservation block
32:	128-byte sector/track
3:	reserved tracks



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To display information about all users on a specific drive:

```
A>STAT B:*. * U:<cr>
Type STAT ? for Help
User      Files    Phy Exts    Space
  0         8        8      19k
  7         4        5      48k
```

Each user is listed, followed by the number of files, physical extents, and space used (— not space available).

### Attributes

There are eight user (advanced user, that is) definable file attributes and three standard, predefined file attributes. The STAT command associates each of the eleven attributes with a specific character position in the file's name and extension. The user attributes are assigned to the eight filename character positions. The examples in this section deal with the predefined attributes associated with the three characters of the filetype extension.

<u>Attribute</u>	<u>Clear</u>	<u>Set</u>	<u>Comments</u>
File access	R/W	R/O	Read/Write or Read/Only
System file	DIR	SYS	SYS files do not show in normal directory.
Archive	Yes	No	Identifies files which are to be archived.

To write protect a file, you must set the file access flag. STAT provides two ways to do this. The most convenient way is with this command expression:

```
A>STAT B:MYFILE.DOC $R/O<cr>
Type STAT ? for Help
File set to R/O.
```

Another way would be to set the flag (T1) with this expression:

```
A>STAT B:YOURFILE.DOC $ST1<cr> (Sets filetype
extension position 1.)
```

Both of the preceding examples have the same effect on both files; the files can only be read. To write enable the file MYFILE.DOC, the file access attribute must be cleared with one of the following expressions:

```
A>STAT B:MYFILE.DOC $CT1<cr> (Clears filetype
extension position 1.)
```

or

```
A>STAT B:MYFILE.DOC $R/W<cr>
```

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Using STAT to return the attribute status of these files will yield this result:

```
A>STAT B:*.DOC<cr>
Type STAT ? for Help
Recs  Bytes  Pex  Acc          B:  MYFILE  .DOC
  91   12k    1  R/W          B:  YOURFILE .dOC
 183   24k    1  R/O
B: R/W Space: 75K
```

Notice that YOURFILE.DOC is still write protected, as indicated by R/O and the lower case first character of the filetype extension.

The procedure is the same for setting the system indicator attribute flag. Either of the following two command lines will set the SYS attribute.

```
A>STAT MEGDRIVE.COM $ST2<cr> (Sets filetype
extension position 2.)
```

or

```
A>STAT MEGDRIVE.COM $SYS<cr>
```

No drive specifier was entered; the default drive is assumed. Using STAT to return the attribute status of this file will yield this result:

```
A>STAT MEGDRIVE.COM<cr>
Type STAT ? for Help
Recs  Bytes  Pex  Acc          A:  MEGDRIVE .CoM
  18    4k    1  R/W
A: R/W Space: 22K
```

The second letter of the filetype extension is displayed in lower case, indicating the system (SYS) attribute is set. Remember, with its system attribute set, MEGDRIVE.COM will not show up in a directory displayed with the DIR command.

Setting the archive attribute is accomplished with this STAT command line:

```
A>STAT WIDGET.DOC $ST3<cr>
```

Whenever STAT is used to check the file status of WIDGET.DOC, STAT will indicate that the archive attribute is set by displaying a lower case character in the third character position of the filetype extension.

This command line will clear the archive attribute:

```
A>STAT WIDGET.DOC $CT3<cr>
```



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All of a file's attributes can be cleared with the following STAT command expression:

```
A>STAT SUBMIT.COM $ALL<cr>
Type STAT ? for Help
Recs      Bytes    Pex    Acc
  18       4k       1    R/W    A:  SUBMIT  .CoM
all attributes cleared
A: R/W Space: 380K
```

#### MEGDRIVE

Install CP/AM MegDrive™

With the MEGDRIVE utility program, the memory available on a Z-Ram or RamWorks™ card can be used to emulate a CP/AM volume (called, MegDrive). A standard (64K) extended 80 column card can also be used, but it will only be able to provide 64K of data storage space. The example, below, illustrates a MegDrive emulation on an Apple //e with a 3 Meg RamWorks card installed.

```
A>MEGDRIVE<cr>
```

Applied Engineering MegDrive v-- ©1987

MEGDRIVE is installed as disk C:

Available storage is 3040K

In this example, MegDrive was installed by entering the MEGDRIVE command. "MEGDRIVE is emulating C:" indicates the MegDrive, designated as drive C, is now installed into 3Meg of available memory. Checking the STATUS of drive C, the emulated disk storage available on drive C is 3040K.

MEGDRIVE assigns drive C as the default MegDrive. If you have a single drive system and wish to assign the MegDrive as drive B, use the command line shown in the next example to initially install a MegDrive. If a MegDrive is already installed, the current MegDrive specifier will be changed to the new drive.

```
A>MEGDRIVE B:<cr>
```

**IMPORTANT:** Be careful not to assign a MegDrive device specifier that is already in use. For instance, activating a MegDrive as B: would override the slot 6, drive 2 disk drive.

To copy files to the CP/AM MegDrive, use the PIP utility. COPY will not copy to or from the MegDrive, nor will it copy the CP/AM 5.1 operating system to the MegDrive. Unlike the RAMcard CP/AM volume (described in the next chapter), the MegDrive cannot be booted.

The MegDrive remains enabled until the computer's power is turned off or the system is cold booted. The CP/AM Control-C warm start does not affect the

MegDrive. When the system is cold booted (Control-⌘-RESET), the MegDrive must be re-enabled by issuing the MEGDRIVE command. Entering the MEGDRIVE command while a MegDrive is already installed has no effect on the files stored in the MegDrive. Holding the Open-Apple (⌘) key down during MEGDRIVE execution will enable the audible disk access indicator.

Just as the red "disk use" indicator light indicates a disk access in progress, MegDrive provides a visual access indicator. Whenever the emulated drive is accessed, an inverse "R" or "W" will appear in the lower right corner of the display. The "R" indicates a read operation; the "W" signifies a write operation.

MEGDRIVE also optionally supports the Double High Resolution Graphics feature of the Apple IIGS, //c and //e by locking out bank 0 of auxiliary memory. If your CP/M program requires the use of double high resolution graphics, or any other portion of bank 0 of auxiliary memory, enter the MEGDRIVE command as shown below.

```
A>MEGDRIVE<cr>
```

Applied Engineering MegDrive v-- ©1987

MEGDRIVE is installed as disk C:

Available storage is 3024K

Memory is configured for Double-HiRes graphics

NOTE: Past RAMDRIVE users should be aware that MEGDRIVE will not create a file called "DBLHIRES".

### AUTORUN

Set startup floppy disk only

AUTORUN allows you to customize a CP/AM boot disk. Whenever an AUTORUN modified system disk is cold booted, the first command line is automatically entered and executed. Any executable command file can be specified. The example below shows how AUTORUN can be used to install a MegDrive whenever the system disk is cold booted.

```
A>AUTORUN MEGDRIVE<cr>
```

CP/AM AUTORUN VER.1.1

```
A>
```

To cancel the startup command file, simply execute AUTORUN without a command argument.

### AUTOPC

Set startup — UniDisk 3.5 or Protocol Converter devices: only

This command supports only devices which are attached to the computer via Apple's Protocol Converter interface (e.g. UniDisk 3.5, RamFactor, and the Apple II Memory Expansion Card). It is invoked in the same manner as AUTORUN.



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### SUBMIT

Automatic sequential command execution

Usually, CP/M commands are entered and executed one at a time from the keyboard. By taking its commands from a special file instead of the keyboard, SUBMIT allows you to group several commands together in a "batch" for sequential processing without your intervention.

The commands to be executed must be valid CP/M commands and contained in a CP/M text file with a filetype extension of .SUB. A SUBMIT command file can be easily created and edited with a CP/M text or line editor. The PIP utility can also be used to create a ".SUB" file. Each line of the text file must contain a valid CP/M expression, followed by a carriage return. In the following example, the TYPE command is used to display the contents of a sample submit file on the CP/AM 5.1 System Master disk.

```
A>TYPE SAMPLE.SUB<cr>
dir
megdrive d:
pip d:=A:pip.com
stat d:

A>
```

When SUBMIT is executed using the SAMPLE.SUB file, as shown in the example below, the commands in the ".SUB" file are executed automatically, one line at a time. SUBMIT creates a temporary command file on the current disk from your ".SUB" file with the filename of "\$@\$.SUB" which it then uses to execute the command sequence. This temporary file is erased upon completion of the command sequence.

```
A>SUBMIT SAMPLE<cr>
```

This example uses the SUBMIT file, SAMPLE.SUB, to first display a directory of drive A, the current drive. Then the following line installs a MegDrive as drive D. In the next line, PIP copies itself into the newly created MegDrive and the last line returns the status of the MegDrive.

To create a SUBMIT command file using PIP, follow the procedure outlined here:

```
A>PIP A:STARTUP.SUB=CON:<cr>
-megdrive<cr>
-pip c:=a:*.com<cr>
-dir c:<cr>
-^Z<cr>
```

The command line in this example creates a file on drive A with the filename of STARTUP.SUB and assigns the keyboard or CON: as the input device. The commands to be executed are then entered following the PIP's hyphen prompts. Each line is ended with a carriage return. The last line, or "end-of-file," is indicated by a control-Z, followed by a carriage return.

SUBMIT and AUTORUN can be used in combination to create a startup disk which will automatically execute a SUBMIT file when the disk is cold-booted. The next example illustrates the AUTORUN command line using SUBMIT and the file created in the previous example.

**A>AUTORUN SUBMIT STARTUP<cr>**

### RAMBOOT

RAMcard re-boot utility

This utility supports both the Applied Engineering RamFactor card and the Apple II Memory Expansion Card. Normally, a control-reset will only reboot the CP/AM operating system. RAMBOOT provides a convenient exit path to or from a RAMcard. The effect of this utility depends on the type of RAMcard installed.

RamFactor: If the RamFactor is dedicated to CP/AM, RAMBOOT accesses the RamFactor Partition Manager menu. If the RamFactor is dedicated to a non-CP/AM operating system and is in "Apple II Memory Expansion Card emulation mode" (i.e. Partition Manager firmware is inactive), the current (bootable) RamFactor volume will be booted. The following message will be displayed if the RamFactor volume is not bootable and the Partition Manager has not been previously accessed:

**WARNING- INSTALLING PARTITIONS DESTROYS  
THE DIRECTORY- GO AHEAD?**

Press "Y" to access the blank RamFactor Partition Manager menu. Pressing any other key will exit to BASIC.

Apple II Memory  
Expansion Card:

RAMBOOT will exit CP/AM and enter the Applesoft BASIC mode (no operating system) if the current RAMcard volume is not bootable.

No RAMcard found: The error message, "Can't find RAMCARD, exiting program!," will be displayed.

### Public Domain Utility Transient Command Files

For your convenience, Applied Engineering has included some useful public domain utility programs on the CP/AM 5.1 System Master disk.

### NSWEEP

This is a disk maintenance utility program that combines many of the features of PIP, STAT, USER, TYPE, ERA, and REN into one menu-driven package. It is very quick and versatile!



# Transient Commands

## Chapter 2

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- SD** SD stands for "Super Directory." It makes up for the features that the DIR system command doesn't have.
- TED** This is a powerful, easy to use text editor. It isn't Wordstar®, but as a simple line-oriented editor, it's very useful.

Detailed user documentation for these public domain programs is also provided on side two of the disk. The instructions for NSWEEP are contained in a standard text file named NSWEEP.DOC on the backside of the CP/AM 5.1 System Master disk. Since disk space is limited, the documentation files for SD and TED have been condensed, or "squeezed" by the NSWEEP program. NSWEEP will convert squeezed files to standard text files with a filename extension of ".DOC." NSWEEP is also capable of printing squeezed files directly.

Standard text files can be displayed on the screen by using the TYPE command and echoed to the printer by toggling the Control-P command. The PIP command can also be used to output all of the documentation files to your printer by using the following command line.

**A>PIP LST:=A:filename.DOC<cr>**

In this command line, "filename.DOC" represents the unambiguous filename of the documentation file you wish to print.

- What's Next...** With the information covered in Chapters 1 and 2, you should now be able to create, view, erase, and transfer CP/AM files. Chapter 3 explains how to create your own bootable disks and, if necessary, how to configure the CP/AM operating system to match the configuration of your computer system.

### CP/AM System Configuration

The first two chapters have given you an introduction to the CP/AM operating system and its commands. This chapter explains how to create your own bootable system disks and how to customize the CP/AM 5.1 operating system to match the configuration of your computer system.

Here are the topics covered in this chapter:

- CP/AM System Disk Description
- Creating a Floppy (5 1/4") System Disk
- Creating a UniDisk 3.5 System Disk
- Creating a RAMcard System Disk
- Configuring the CP/AM 5.1 Operating System
- Configuring Non-Standard //c Serial Ports
- CP/AM for 48K Computers

#### CP/AM System Disk Description

A system disk contains the CP/AM operating system on specific tracks the disk, called boot tracks. Whenever a system disk is booted, the operating system is loaded into memory from the boot tracks. The boot tracks of a standard 5 1/4 inch floppy disk, tracks 0, 1, and 2, are normally reserved as boot tracks, but if no operating system is written to them, they can be used to store data. The boot tracks of a CP/AM formatted UniDisk 3.5 are permanently reserved for the operating system only. A non-system disk can only store data; it cannot be booted.

There are four transient program (.COM) files on the CP/AM System Master disk which, when executed, will install or replace the operating system on the boot tracks of a formatted CP/AM disk. Two of the programs, CPAM60S and CPAM60F, will install the CP/AM 5.1 operating system on a standard (5 1/4) floppy disk only. The other two programs, CPAM60US and CPAM60UF, will install the operating system only on a UniDisk 3.5. The PC program, described later in this chapter, is used to install the operating system on a RamFactor or an Apple II Memory Expansion card.

The "S" and "F" variations of the operating systems offer two different video device drivers. (A device driver is a software routine that is called by the operating system when it needs to interface with a specific type of input or output device—in this case, the video screen.) The "S" (standard) version uses a "firmware screen output driver," as opposed to the faster direct "hardware output driver" used by the "F" (fast) version. The fast driver allows the video display to scroll approximately 30 percent faster. The fast driver also has two other features useful to Wordstar users: "delete line" (Esc E) and "insert line" (Esc R) are supported by the "F" versions of the operating system.



# System Configuration

## Chapter 3

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The standard driver is compatible with all 80 column displays except the Franklin Ace 2x00 series display, which requires the fast video driver. Computers which have an 80 column text card installed in expansion slot three must use one of the standard video driver versions of the CP/AM 5.1 operating system. (i.e. Apple II, Apple II Plus, and Franklin Ace 1x00.)

The fast video driver is recommended for computers which use or emulate an *Auxiliary Slot* 80 column text card. (i.e. Apple IIgs, Apple IIc, Apple IIe, Franklin Ace 2x00, and Laser 128.)

### Creating a Floppy (5 1/4") System Disk

The first step in creating a system disk (either floppy disk or UniDisk 3.5) is to install the appropriate video driver on a COPY of the CP/AM 5.1 System Master disk. The operating system loaded from the CP/AM 5.1 System Master contains the standard video driver. This version can be updated (replaced) by booting a COPY of the System Master and entering the CPAM60F command, as shown in the example below.

```
A>CPAM60F<cr>
```

```
CP/AM Ver 5.1 UPDATE PROGRAM  
(C) 1986 APPLIED ENGINEERING
```

```
FOR HARDWARE 80-COL ONLY!  
INSERT DISK INTO DRIVE A:  
AND PRESS RETURN TO BEGIN
```

When the fast driver operating system is then booted, the following message will be displayed below the CP/AM copyright notice:

#### HARDWARE 80-COLUMN DRIVER IN USE

*Note: At this time, you may wish to delete some of the unnecessary files from your COPY of the System Master disk. If you will be configuring the operating system to support the UniDisk 3.5 or other Protocol Converter device, you will need at least 15K of available disk space to save the system configuration file.*

Before the CP/AM operating system can be installed on a floppy disk, the disk must be formatted in CP/AM format. (The FORMAT command is explained in Chapter 2.) Once properly formatted, either the CPAM60S or CPAM60F programs can be executed to write the operating system to the disk's boot tracks.

After the operating system is installed, PIP or NSWEEP can be used to copy the desired transient command files (programs) from another disk.

*Note: The operating system tracks can also be copied from one floppy disk to another floppy disk by using the "/S" feature of the COPY command. Attempting to use this method to copy the operating system from a floppy disk to a UniDisk 3.5 will result in an error message.*



# System Configuration

## Chapter 3

### Creating a UniDisk 3.5 System Disk

The standard CP/AM 5.1 operating system on the CP/AM 5.1 System Master does not automatically recognize devices which use Apple Computer's Protocol Converter bus interface. The standard Disk II floppy disk interface is not a Protocol Converter device, but the UniDisk 3.5 is. Before a UniDisk 3.5 can be formatted and its operating system installed, the CP/AM 5.1 operating system loaded into memory from the floppy disk must be configured to recognize the UniDisk's Protocol Converter interface.

The Protocol Converter is a sophisticated program which provides a standardized method of attaching a series of mass storage devices (disks) to the Apple //c disk port or a UniDisk 3.5 interface. These devices are linked along a common data channel called the Protocol Converter bus. The firmware (Read Only Memory) on the Apple II Memory Expansion Card and the RamFactor also provides the features of the Protocol Converter for one I/O device — the memory card itself.

Boot your COPY of the CP/AM 5.1 System Master disk. If you have not already done so, install the operating system with the video driver you wish to have installed on the UniDisk 3.5 system disk. Execute the PC.COM transient program and add the UniDisk 3.5 into the device table as any device except the A: drive. Save the configuration file to the floppy disk. Accept the default name of CAUTO.COM. An error message at this point probably indicates there is not enough room on the disk for the CAUTO.COM configuration file. If necessary, reboot, ERase any unnecessary files, and begin the configuration procedure again.

Whenever the configured floppy disk is booted, the operating system automatically executes the CAUTO.COM file, which installs the specified configuration. The UniDisk can then be formatted (FMTUNI) and the desired operating system written to the UniDisk's boot tracks (CPAM60US or CPAM60UF).

### Creating a RAMCARD System Disk

Since the RamFactor and Apple II Memory Expansion cards are Protocol Converter devices, the PC utility, provided on the CP/AM 5.1 System Master disk, is used to install the operating system. If the operating system is to be installed on the RamFactor partition, you must first use the RamFactor Partition Manager menu to set the desired partition number, size, and name. It is not necessary to set the partitions if RamFactor is to be totally dedicated to CP/AM (emulating the Apple II Memory Expansion Card).

Note: IIGS users should refer to Appendix A for specific information about setting up the PC menu for the IIGS.

Boot the CP/AM 5.1 System Master disk. If you have not already done so, use either the CPAM60S or CPAM60F command to install the operating system with the video driver you wish to install on the RAMCARD volume. Execute the PC.COM transient program and add and install the RAMCARD device as the A: drive. As prompted by the PC program, write the CPAM60UF.COM operating system to the A: device.

The RAMCARD volume can now be booted just like any other disk drive. If the RAMCARD is in expansion slot 7 of an enhanced Apple //e, the A: volume will be booted by a Control-⌘-Reset.

Reminder: The RAMCARD's RAMdisk is a volatile storage medium! When the computer's power is removed, even for an instant, information stored in a RAMdisk is completely lost — unless you have a RamFactor equipped with a RamCharger™ (battery back up and auxiliary power supply).



# System Configuration

## Chapter 3

**WARNING:** If you write a file to the RAMdisk using a different operating system, it will override the previous operating system. For example, if you are currently in CP/AM and you write a file to the RAM disk using Pascal, you will lose your CP/AM files currently in your RAM disk. A list of the files may still be displayed but the actual files will be gone.

### Configuring the CP/AM 5.1 Operating System

Special configuration is only required to support devices which use Apple Computer's Protocol Converter bus. Standard (Disk II) type floppy disk interfaces and most hard disk interfaces do not use the Protocol Converter.

The PC.COM utility, provided on the CP/AM 5.1 System Master disk, is a menu-driven program which will allow you to configure the CP/AM 5.1 operating system to:

- recognize a UniDisk 3.5 interface or other Protocol Converter device.
- recognize a IIGS SmartPort device (3.5 drive or memory expansion card).
- create a bootable RamFactor or Apple II Memory Expansion Card volume.
- assign the primary boot device. (drive A:)
- arrange the mass storage (disk) device table.

The PC device table can be configured to support a combination of six disk devices. These devices include:

- GS Memory Expansion slot card or SmartPort devices in a IIGS
- Standard Disk II type interfaces
- Protocol Converter bus interface devices (UniDisk 3.5)
- Protocol Converter RAMCARD devices (RamFactor; Apple II Memory Expansion Card)
- GS-RAM, or RAM card
- Sider Hard Disk interface device (installed separately by Sider installation program, described in Appendix C)

Note to Sider hard disk users: Install the CP/AM 5.1 operating system onto the Sider *before* using the PC utility to install Protocol Converter devices. (refer to Appendix C).

When executed from an unmodified CP/AM 5.1 operating system, the PC command will display this Device Table:

DRIVE	DEVICE NAME	UNIT #
A:	APPLE DISK II	1
B:	APPLE DISK II	2
C:	APPLE DISK II	3
D:	APPLE DISK II	4
E:	APPLE DISK II	5
F:	APPLE DISK II	6

A - Add device(s)      R - Restart from scratch  
Q - Quit w/ no update    S - Set last valid device  
Any other = Install as above

PC.COM V1.0 - Choose action =====> A

# System Configuration

## Chapter 3

The Device Table reflects the standard (default) CP/AM configuration for disk interfaces, as shown in the following chart. The DEVICE NAME column indicates the current *device type* assigned to the corresponding drive specifier.

CP/AM device Drive Specifier	Physical Apple Slot	Interface Drive
A:	6	1
B:	6	2
C:	5	1
D:	5	2
E:	4	1
F:	4	2

Configuration begins by selecting the A (Add devices) option. The PC program will then search the system for all Protocol Converter device types and display this screen:

### PC BLOCK DEVICES FOUND:

TYPE	SLOT/PORT #
-----	
RAMCARD	NONE
SmartPort	5

Choose interface by slot (0= Main menu):

Had the program found a RamFactor card or an Apple II Memory Expansion card, the memory card slot numbers(s) would be indicated also. When the desired slot number is entered, the program again displays the current device table, but prompts you to:

Start installation at which drive? (A-F):

The device specifiers (A:, B:, ...) assigned to a particular device type determines the relative positions of the other disk device types in the system. If one device type is installed as the A: drive, it is inserted ahead of the current A: device, shifting all remaining devices in the device table. If the F: drive was a valid device, it would then "fall off" the end of the device table. For instance, by installing a Protocol Converter device as the A: drive, the slot 6, drives 1 and 2 disks become the B: and C: drives, and so on.

If a new device is added to the device table list at a point other than the first device in a sequence of device types, the new device (or devices) will overlay the remaining list of devices, until a different device type is encountered. Put another way: if a new device splits a device type list, the subsequent devices of the same type in that type list are inactivated. For this reason, you should insert new devices only at the beginning of a list of a given device type, so that the remaining devices of that type will be shifted rather than deactivated.



# System Configuration

## Chapter 3

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Note to MegDrive users: When the MEGDRIVE program is executed, it actually creates its own device driver and does not need to be included as a valid device. Be careful, when installing a MegDrive, to make sure that the MegDrive device specifier does not conflict with a current valid device.

After a Protocol Converter type of device has been inserted into the device table, this prompt will be displayed:

UNIT #	DEVICE NAME	SIZE IN K
1	DISK 3.5	800

Enter # of devices to install (Maximum = 1):

The maximum number of devices allowed is determined by the type and number of devices attached to the Protocol Converter bus. For example, two daisy-chained Protocol Converter drives would allow installation of two devices (e.g. A second UniDisk 3.5 drive connected to the output of the first drive).

The updated configuration is indicated by the new device table display. Configuration for any additional Protocol Converter devices can be done at this time by reselecting the A option from the option menu. Once all Protocol Converter devices have been added to the system, use the S option to set the LAST valid device in the system. Setting the last valid drive assures an error message will be generated by the operating system if an invalid drive is specified.

The operating system in memory is now configured to support the devices shown on the device table. The next step is to save this configuration to the appropriate disk. This is accomplished by pressing the spacebar or Return key at the PC.COM "Choose action" prompt. If a Protocol Converter device was installed as the A: device, you will be allowed to write the CP/AM 5.1 operating system to the new A: drive. The default system installation file is CPAM60UF.COM, but the video driver to be installed is determined by the video driver in use by the operating system in memory.

Reminder: The CP/AM disk that is supplied is full. You will need to ERase some of the utility programs **from your backup** to make room for saving your configuration. ERase enough to free at least 15K.

The configuration shown in the device table can be saved to a configuration file on a disk. CAUTO.COM is the default name for the configuration command file. This command filename is automatically executed as part of the system disk boot sequence. You can use the PC utility to create different configuration files under different command filenames, boot a generic (not configured) operating system, then manually execute a specific command for a specific configuration.

# System Configuration

## Chapter 3

**IMPORTANT:** If the physical configuration of the system is ever changed in any way, the configuration file will also have to be updated.

### Non-Standard //c Printer Port Configuration

The CP/AM operating system uses the default Product Identification Numbers (PIN) for output to the printer port (LST: device) and communications port (PUN: and RDR:.) Each time the //c is turned on, the following Product Identification Numbers are in effect for serial ports 1 and 2:

PORT 1(Default) Product Identification Number: 166/1124

- (1) Printer mode
- (6) 8 Data bits/2 stop bits
- (6) 9600 baud (bits per second)
- (1) No parity
- (1) No echo of output to screen
- (2) Insert line feed after carriage return
- (4) Insert carriage return after 80 characters

PORT 2 (Default) Product Identification Number: 152/1121

- (2) Communications mode
- (5) 8 Data bits/1 stop bit
- (2) 300 baud (bits per second)
- (1) No parity
- (1) No echo of output to screen
- (2) Insert line feed after carriage return
- (1) Do not insert carriage return

If your printer or communications device does not work properly with the default PIN, use the Apple //c System Utilities disk to reconfigure the PIN. The instructions for changing the PIN are in the Apple //c Owner's Manual or the Apple //c System Utilities manual.

If you are required to use a non-default PIN setting, you must boot the properly configured Apple //c System Utilities disk prior to booting into the CP/AM operating system. Remember, a warm boot (Control-⌘-Reset or PR#6) will not erase the PIN currently in effect. A cold boot (power-off/power-on) will reset the PIN to the default setting.



# System Configuration

## Chapter 3

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### CP/AM 4.0B for 48K Computers

CP/AM 5.1 requires at least 64K of Random Access Memory (RAM) and an 80 column display capability. For computers with only 48K of RAM or for systems with only 40 column capability, a 44K version of the CP/AM 4.0B operating system has been provided on the back side of the CP/AM 5.1 System Master disk.

**Note:** If you have a 64K computer without 80 column capability, you can use CP/AM 60K in the utilities menu. It has all the features of 5.1 but does not require 80 columns.

**Warning:** Make a backup copy of both sides of the CP/AM 5.1 System Master. The back side is specially partitioned to contain both DOS 3.3 files and CP/AM files. Writing any data to the original disk may destroy its contents.

Certain utility programs (transient commands) provided on the front side of the System Master will not work under CP/AM 4.0B. Compatible versions of some of these utilities have been included on the CP/AM 4.0B side of the System Master disk.

CP/AM 5.1 60K Command	CP/AM 4.0B 44K Command
AUTORUN	AUTORUN4
FORMAT	FORMAT4
CONFIGIO	CONFIG4
COPY	COPY4

FMTUNI, AUTOPC, and RAMBOOT will work only with the 5.1 version; they will not work with the 4.0 version.

To create a bootable CP/AM 4.0B System Master, use the FORMAT4 command to format a blank CP/AM disk. Then, execute the CPAM44K command to install the 44K version of CP/AM 4.0B operating system onto the boot tracks of the disk. Boot the new system disk and insert a copy of the CP/AM 5.1 System Master in the B: drive. Specify B: as the current drive and use PIP to copy the desired command files. (No second drive? Use the PIP [J] parameter.)

### What's Next...

Unless you are an experienced Z-80 assembly language programmer, you're through!

### CP/AM Technical Reference

- Important!** This section is intended for Z-80 machine language programmers **only!** All others should stay away or risk mental meltdown. The technical information about CP/AM 5.1 contained in this section is provided specifically for those programmers using CP/M program development tools. (These tools are not provided with the CP/AM 5.1 System Master disk.)
- CONFIGIO** Configure Input/Output Parameters
- This command utility allows the advanced CP/M machine language programmer to reconfigure the CP/AM operating system by redefining selected operating system parameters. The screen function definitions can be modified, keyboard characters can be redefined, and user specified system I/O drivers can be installed. All values, displayed and input, are in hexadecimal notation. CONFIGIO menu options 1, 2, and 3 modify the parameters of the operating system currently in memory. Option 4 allows the current operating system I/O configuration block to be written to (or read from) a CP/AM system file on disk.
- Menu Option 1** **Configure CP/AM Terminal Emulation.** The Terminal Screen Function Definition screen displays the current software and hardware screen function definitions. The CP/AM 5.1 Operating System is initially configured to emulate the SOROC IQ 120/ IQ 140 terminals and, if changed, can be reset to this default by selecting option M.
- The software definition column specifies the hexadecimal character string required of the program to accomplish the desired screen function. The hardware definition column specifies the character sequences, issued by the operating system, to be sent to the terminal upon receipt of the software definition sequences. The Lead-In character option allows the lead-in character to be specified for all screen functions requiring a lead-in character. The XY Coordinate Offset option and the XY Transmit Order option are used in combination to establish the operating system cursor coordinate protocol. Table 4-3 provides the memory locations associated with the Screen Function Definitions.
- Menu Option 2** **Redefine Keyboard Characters.** This configuration option was originally designed for earlier Apple II computers which did not have all the keys necessary to run CP/M software. While this is of little use to Apple //c and //e users, up to six keyboard characters can be redefined. As the initial default, there are no keys redefined. Table 4-2 contains the memory locations associated with the original keyboard character and the redefined character.



# Technical Reference

## Chapter 4

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- Menu Option 3    **Load User I/O Drivers.** Using this option, special user-written system I/O driver files can be loaded into the operating system currently in memory. Please refer to the paragraph entitled "Custom CP/AM Input/Output Drivers," for examples and details on the proper file format.
- Menu Option 4    **Read/Write I/O Configuration Block.** This option allows the current operating system configuration block to be written to the CP/AM system file of a floppy disk. It also allows the configuration block to be read from a floppy disk's system file.

Table 4-1: Z-80 / 65C02 Memory Address Translation

This table provides the corresponding memory maps for the Z-80 and 65C02 processors.

Z-80 ADDRESS	65C02 ADDRESS
0000H-0FFFH	\$1000-\$1FFF
1000H-1FFFH	\$2000-\$2FFF
2000H-2FFFH	\$3000-\$3FFF
3000H-3FFFH	\$4000-\$4FFF
4000H-4FFFH	\$5000-\$5FFF
5000H-5FFFH	\$6000-\$6FFF
6000H-6FFFH	\$7000-\$7FFF
7000H-7FFFH	\$8000-\$8FFF
8000H-8FFFH	\$9000-\$9FFF
9000H-9FFFH	\$A000-\$AFFF
A000H-AFFFH	\$B000-\$BFFF
B000H-BFFFH	\$D000-\$DFFF
C000H-CFFFH	\$E000-\$EFFF
D000H-DFFFH	\$F000-\$FFFF
E000H-EFFFH	\$C000-\$CFFF
F000H-FFFFH	\$0000-\$0FFF

Table 4-2: Keyboard Redefinitions

Compared Character Location	Redefined Character Location
F3ACH	F3ADH
F3AEH	F3AFH
F3B0H	F3B1H
F3B2H	F3B3H
F3B4H	F3B5H
F3B6H	F3B7H

Table 4-3: Screen Function Definitions

Software	Hardware	Description
F396H	F3A1H	The cursor coordinate offset is contained in the least significant 7 bits (0-6) of this byte. The most significant bit (7) is the transmit order of the X and Y coordinates. If bit 7 is zero the Y coordinate is transmitted first. If it is a one, the X coordinate is first.
F397H	F3A2H	Lead-in character. Zero if no lead-in.

Note: In following bytes, the most significant bit (7) specifies that a lead-in character is required for the given function. Bits 0-6 contain the character that corresponds to that particular function. A byte value of zero indicates the given function is disabled.

F398H	F3A3H	Clear screen
F399H	F3A4H	Clear to end of page
F39AH	F3A5H	Clear to end of line
F39BH	F3A6H	Normal text
F39CH	F3A7H	Inverse text
F39DH	F3A8H	Home cursor
F39EH	F3A9H	Address cursor
F39FH	F3AAH	Move up one line
F3A0H	F3ABH	Non-destructively move cursor forward

**Custom CP/AM Input/Output Drivers** The following is the I/O driver file format required by CONFIGIO:

Byte:	
1	Number of custom drivers contained in this file
2	LS (least significant) byte of destination address of subroutine code
3	MS (most significant) byte of destination address of subroutine code
4	LS byte length of subroutine code
5	MS byte length of subroutine code
6	Driver type (1 or 2)
Type 1	(Unchained drivers)
7	I/O vector number to be modified (see Table 4-4)
8	LS byte of address to be placed into I/O vector defined in byte 7
9	MS byte of address to be placed into I/O vector defined in byte 7
Type 2	(Chained drivers)
7	I/O vector number to be modified (see I/O Vector table)
8	LS byte of address to which the current contents of I/O vector indicated in byte 7 is to be loaded
9	MS byte of address to which the current contents of I/O vector indicated in byte 7 is to be loaded
A...n	Driver object code, the length of which is specified by bytes 4 & 5
n+1	Beginning of the next custom driver



# Technical Reference

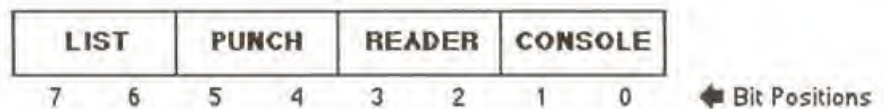
## Chapter 4

Table 4-4: Input/Output Vectors

Vector Number	Vector Address	Vector Name	Description
1	0F380H	Console Status	Returns 0FFH in register A if a character is ready to read and 00H if otherwise.
2	0F382H	Console Input #1	Read a character from the console into the A register
3	0F384H	Console Input #2	
4	0F386H	Console Output #1	Sends a character in register C to the console device. Register B contains zero if a standard character or if sending out a screen function command it contains the screen function number.
5	0F388H	Console Output #2	
6	0F38AH	Reader Input #1	Reads a character from the reader device (Slot 2) into register A.
7	0F38CH	Reader Input #2	
8	0F38EH	Punch Output #1	Sends the character in register C to the 9 punch device (Slot 2).
	0F390H	Punch Output #2	
A	0F392H	List Output #1	Sends the character in register C to the printer device (Slot 1).
B	0F394H	List Output #2	

### Logical to Physical I/O Devices

The CP/AM IOBYTE at location 0003H can be used to redirect the logical input and output devices to different I/O vector table locations. The IOBYTE has the following structure:



#### Console field

- 0 Console Input #1 and Console Output #1
- 1 Console Input #1 and Console Output #1
- 2 Reader Input #1 and List Output #1
- 3 Console Input #2 and Console Output #2

#### Reader field

- 0 Console Input #1
- 1 Console Input #1
- 2 Reader Input #1
- 3 Reader Input #2

### Punch field

- 0 Console Output #1
- 1 Punch Output #1
- 2 Reader Input #2 (data is output through this vector)
- 3 Punch Output #2

### List field

- 0 Console Output #1
- 1 Console Output #1
- 2 List Output #1
- 3 List Output #2

The area within the CP/AM operating system, reserved for user installed device drivers, is located from F200H to F37FH. Be aware that the RAMDRIVE program uses the I/O block area from F200H to F2FFH.

Here is an example of a device driver routine to remove line feed characters:

```
;List device driver.
;
;
ORIGIN   ORG   100H           ;Load subroutine at 100H.
EQU      EQU   0F300H        ;Actual origin of driver.
OFFSET   EQU   ORIGIN-START
;
;
DB       1                   ;Number of custom drivers.
DW       0F300H              ;Address to load driver.
DW       PGMEND-START        ;Length of driver code.
DB       2                   ;Driver patch type.
DB       0AH                 ;I/O vector number.
DW       OUTPUT+OFFSET+1     ;Address to store current vector
                             ;contents.
DW       START+OFFSET        ;New I/O vector address.
;
START:   LD       A,C         ;Move output character to register A.
CP       0AH                ;Check for line feed character.
OUTPUT:  CALL     NZ,0000H     ;If not line feed, send character to
                             ; printer.
                             ; If line feed, not send to printer.
                             ; Continue.
RET                               ;Return to calling program.
;
END
```

The object code for this driver would be:

01 00 F3 07 00 02 0A 04 F3 00 F3 79 FE 0A C4 00 00 C9



# Technical Reference

## Chapter 4

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### Interrupt Handling

From the way that the Z-80 card uses the DMA line to deactivate the 6502, all interrupt processing must be handled by the 6502. To enable maskable interrupts, the IRQ solder pad on the Z-80 card must be connected; non-maskable interrupts are not available. If the interrupt takes place when the 6502 is active, interrupt handling is done in the standard way. When the Z-80 is active, the following steps must be taken:

1. Save any registers that are destroyed on the stack.
2. Save the contents of the 6502 subroutine call address in case an interrupt has occurred during the preparation for a 6502 subroutine call.
3. Set up the 6502 subroutine call address to \$FF58, which is the address of a 6502 RTS instruction in the Apple monitor ROM.
4. Return control to the 6502 by writing to the slot address of the Z-80 card. When the 6502 regains control it will immediately "see" the interrupt and jump to its interrupt handling routine. Upon return from the interrupt routine, the 6502 will execute the RTS instruction and reactivate the Z-80 through the call manager.
5. When the Z-80 is reactivated, restore the previous 6502 subroutine call address.
6. Restore all used Z-80 registers from the stack.
7. Enable Z-80 interrupts with the EI instruction.
8. Return from Z-80 interrupt routine with RETI.

### SHIFT.MOD

A sample I/O device driver file, SHIFT.MOD, is provided on the back side of the CP/AM 5.1 System Master disk. For Apple II or II Plus owners with the "one-wire" shift key modification, this device driver will allow lower case keyboard input. Also, the control-K character, required by the Wordstar program, will not be suppressed. Once this driver is installed, shift-0 (zero) will function as the shift-lock key.

CONFIGIO option 3 is used to load the SHIFT.MOD driver file from the disk in the A: drive. Option 4W can then be used to write the I/O configuration block to disk. The assembly language print file for this driver, including comments, is contained in the text file SHIFT.PRN.

### Calling 65C02 Subroutines

Address (65C02) of subroutine must be placed in memory location F3D0H. Register contents required by the subroutine can be placed in the Register Pass Table (see Table 4-5). Then the following two instructions must be executed:

```
LD HL,(0F3DEH)
LD (HL),A
```

When the above instructions are executed, the Z-80 is temporarily disabled and the 65C02 registers are loaded from the corresponding Z-80 memory locations in the register pass table. Upon completion of the 65C02 subroutine, the contents of the register pass table will be the results, if any, of the subroutine.

## Technical Reference

### Chapter 4

Table 4-5: Register Pass Locations

Z-80 Address	65C02 Address	Description
F045H	\$0045	65C02 A register.
F046H	\$0046	65C02 X register.
F047H	\$0047	65C02 Y register.
F048H	\$0048	65C02 P (status) register.
F049H	\$0049	65C02 S (stack) register.
F3D0H	\$03D0	65C02 subroutine address.
F3DEH	\$03DE	Z-80 Slot address.

This is a sample Z-80 call to a 6502 monitor subroutine to beep the Apple speaker:

```
;Z-80 subroutine to beep the Apple speaker
;
Z80      EQU    0F3DEH    ;Z-80 address.
A$SUB    EQU    0F3D0H    ;65C02 subroutine pointer.
REG$A    EQU    0F045H    ;65C02 A register.
BEEP     EQU    0FF3AH    ;Address of 65C02 subroutine.
;
START:   XOR     A        ;Clear the A register.
         LD      (REG$A),A ;Demonstration of parameter passing.
         LD      HL,BEEP   ;Load HL with address to be called.
         LD      (A$SUB),HL ;Store 65C02 subroutine pointer.
         LD      HL,(Z80)  ;Get Z-80 address.
         LD      (HL),A    ;Write to Z-80 address.
;
;65C02 subroutine executed and Z-80 reactivated.
;
         RET              ;Return from Z-80 subroutine.
;
         END
```



# IIGS Users

## Appendix A

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### Apple IIGS Users

#### Setting the Control Panel Menu

Those using the Z-80 Plus in the IIGS will need to set the Control Panel menu to run CP/AM. You should already be familiar with how to change settings with the Control Panel. If you are not, please refer to "Appendix A" in your *Apple IIGS Owner's Guide*.

Note: You must set up the Control Panel before you run CP/AM. CP/AM does not support interrupts.

In the Control Panel menu, set the options as follows:

- Set "System Speed" to "Normal."
- Set the slot containing the Z-80 Plus to "Your Card."
- If disk drives are connected to the SmartPort:
  - set slot 5 to "SmartPort" for the 3.5 disk drive(s).
  - set 6 to "Disk Port" for a floppy disk daisy-chained to the back of a 3.5.
- If you are using a controller card for the 5.25 drive(s), set slot 6 to "Your Card."

Exit the Control Panel by choosing the "Quit" option from the menu and you are ready to boot the CP/AM disk.

Note: If you are using a floppy disk as your startup device and the following message appears: "NO A.E. Z-80 CARD FOUND," simply reboot by pressing CONTROL-(OPEN APPLE)-RESET.

#### RAM Disk Notes

If a IIGS is set up for a RAM disk in the Control Panel menu, the RAM disk will show up as a RAMCARD attached to the SmartPort on the PC menu.

The PC program will recognize up to four 3.5 disk drives daisy chained to the SmartPort and a maximum of 6 devices in all. These will be listed as A-F in the PC menu.

If you want the RAM disk (RAMCARD) to be your startup device, you must set the RAM disk as your startup device in the IIGS Control Panel Menu then turn the power off and back on again. The message, "CHECK STARTUP DEVICE" will appear on the screen. Press, "Control-Reset" to get the cursor, then type, "PR#n" (n=slot # that will access your CP/AM disk). Now access your PC menu. The RAM disk will appear as device A: RAMCARD.

If you do not want the RAM disk as a device, select the RAM Disk option from the Control Panel menu and set the RAM disk's memory allocation to 0. Turn the power off then back on to initiate the new settings.

Refer to page 31 and following for more information about the PC menu.

### Using Wordstar with CP/AM

#### CWS33X

There are some versions of the Wordstar word processing program that may not run under the CP/AM operating system. This is due to the manner in which these versions identify the host Z-80 card. The CWS33X program will modify certain parameters within the CP/AM operating system in order to compensate for Wordstar's erroneous identification of the Applied Engineering Z-80 card. This will also enable proper display of the inverse video portions of the Wordstar screen. The CWS33X modifications to the operating system in memory remain in effect until the operating system is rebooted.

Use this configuration program only if your version of Wordstar does not run properly, as CWS33X has one adverse effect on Wordstar: it will disable the Wordstar Apple-Function key feature.

Important: When installing Wordstar, you will need to identify the Applied Engineering Z-80 Plus card as a standard Micro Soft Softcard.

#### Automatic Execution of CWS33X and Wordstar

The AUTORUN and SUBMIT commands and the STARTWS.SUB file on the CP/AM 5.1 System Master disk can be used to automatically execute CWS33X—then run Wordstar. To do this you must first create a Wordstar startup disk consisting of the following files:

##### CP/AM 5.1 System Master files:

(The CP/AM 5.1 60K operating system.)

CWS33X.COM

SUBMIT.COM

AUTORUN.COM (or AUTOPC for UniDisk 3.5 or RamFactor)

STARTWS.SUB (This file is on side two of the System Master disk.)

##### Wordstar files:

WS.COM

WSOVLY1.OVR

WSMSG5.OVR

Boot the Wordstar startup disk and enter the following command line at the "A>" prompt:

**A>AUTORUN SUBMIT STARTWS<cr>**

Boot the Wordstar startup disk again. Voilà! Wordstar. For more information on customizing your own startup file, refer to SUBMIT and AUTORUN command descriptions in Chapter 2, *Transient Commands*.



# Wordstar and CP/AM

## Appendix B

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### Wordstar Video Displays

Some versions of Wordstar may not display the text on the screen properly. The Wordstar edit screen should be displayed in normal video (light letters on a dark background) and the menus and help screens should be displayed in inverse video (light background with dark letters.)

By using the CONFIGIO program, it is possible to permanently modify a copy of the CP/AM 5.1 operating system to support the proper display of Wordstar inverse video screens.

- Use the PIP program to copy the CONFIGIO.COM program from the CP/AM 5.1 System Master to the disk containing the CP/AM 5.1 operating system you will be using with Wordstar, the "Wordstar system disk." (CONFIGIO is an acronym for CP/AM Input/Output Configuration Program.)
- Execute CONFIGIO from the Wordstar system disk. (A>CONFIGIO<cr>)
- Select option 1 <cr> (Configure CP/AM Terminal Emulation) from the main menu.
- Select option E <cr> (Lo-Lite Text) from the Terminal Screen Function Definitions menu.
- Specify N <cr> to the prompt, "LEAD-IN CHARACTER REQUIRED (Y/N?)."
- Enter: 0F <cr> (zero F) for the CHARACTER CODE.
- Enter: H <cr> (hardware)
- Select option F <cr> (Hi-Lite Text) from the Terminal Screen Function Definitions menu.
- Specify N <cr> to the prompt, "LEAD-IN CHARACTER REQUIRED (Y/N?)."
- Enter: 0E <cr> (zero E) for the CHARACTER CODE.
- Enter: H <cr> (hardware)
- Select option X <cr> (EXIT) from the Terminal Screen Function Definitions menu.
- Select option 4 <cr> (READ/WRITE I/O CONFIGURATION BLOCK) from the main menu.
- Specify W <cr> to the prompt, "READ-WRITE-EXIT (R/W/X)?"
- Press return. (Your Wordstar system disk should already be in the A: drive.)
- Select option X <cr> (EXIT) from the main menu.

The CP/AM 5.1 operating system on your Wordstar system disk is now modified to display normal and inverse Wordstar video screens properly.

### Sider Hard Disk Support

The installation of the CP/AM 5.1 operating system on the Sider hard disk is a three step procedure. Step one involves the configuration of the Sider's Main Menu program. Step two deals with setting the CP/AM startup defaults and actually installing the operating system on the boot volume. Step three involves copying the desired CP/AM command files to the boot volume.

#### Before You Begin...

If you have not already done so, make a backup copy of both sides of the CP/AM 5.1 System Master disk! Any disk duplication program will work. Remember to store the originals in a safe place.

Note: Side two (the backside) of the CP/AM 5.1 System Master disk has been specially created to contain both DOS 3.3 files and CP/AM files. If you catalog the disk under the DOS 3.3 operating system, the DOS files will be shown. Listing a directory under the CP/AM operating system will display the CP/AM files on the disk.

Make sure the Z-80 Plus and Sider hard disk are properly installed in your computer. If you have any doubts, double check the installation procedure in the appropriate User's Manual.

**IMPORTANT:** CP/AM 5.1 must be installed on the Sider hard disk and configured before using the PC.COM utility to establish the system configuration. Once the Sider's CP/AM startup defaults have been established, the PC (Protocol Converter) utility can be used to rearrange the CP/AM device table to include devices which support Apple's Protocol Converter (i.e. UniDisk 3.5, RamFactor, and the Apple II Memory Expansion Card).

#### Step 1. Configuring the Sider Main Menu program.

Start up from the Sider. Check the version number of the Main Menu program, shown in the upper right corner of the screen. If the version is 4.0 or later, skip the rest of this step and proceed to Step 2. Versions prior to 4.0 must be patched to recognize the CP/AM operating system. Version 4.0 already supports Applied Engineering's CP/AM 5.1 operating system.

Insert side two of the CP/AM 5.1 System Master disk in the slot 6, drive 1 disk drive. Select Sider Main Menu option 3, "BOOT INTO DOS." At the Applesoft BASIC prompt ( ), type:

```
RUN INSTALL.CPAM,S6,D1,<cr>
```

When the configuration is complete, the program will return to the Sider's Main Menu. Remove the configuration disk from the disk drive.



# Sider Support

## Appendix C

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### Step 2. Setting the CP/AM Startup Defaults.

Insert side one (frontside) of the CP/AM 5.1 System Master disk in the Slot 6, Drive 1 disk drive. Select Sider Main Menu option 6, "Boot into Slot 6." At the CP/AM prompt ( > ) enter:

APATCH12<cr> (see footnote)

The following menu will appear on the screen:

**First Class Peripherals**  
**Installation program for Applied Engineering CP/AM - 5.X**

**Version 1.2**  
**(C) Copyright 1986**

- 1) Install with hard disk as A:, B:, C:, D:
- 2) Install with hard disk as C:, D:, E:, F:
- 3) Quit with no modifications made

Select one of the above ==>

Option 1 Choose this option if you wish to boot CP/AM as the A: volume each time you select the "BOOT INTO CP/M" option from the Sider Main Menu. The CP/AM 5.1 operating system will be installed on the Sider's A: volume. Volumes B:, C:, and D: will be created as additional storage devices. Drives E: and F: are assigned to the slot 6 floppy disk drives 1 and 2 respectively.

- A: Sider boot device. CP/AM 5.1 Operating System.
- B: Sider CP/AM storage device.
- C: Sider CP/AM storage device.
- D: Sider CP/AM storage device.
- E: Slot 6, Drive 1 (Disk II) CP/AM storage device.
- F: Slot 6, Drive 2 (Disk II) CP/AM storage device.

Option 2 This option assigns the Sider boot volume, A:, to the Slot 6, Drive 1 floppy disk drive and creates additional storage devices, C:, D:, E:, and F: on the Sider. Drive B: is assigned to Slot 6, Drive 2. By choosing this option, you must have a bootable CP/M disk in Drive A:

- A: Slot 6, Drive 1 boot device.
- B: Slot 6, Drive 2 CP/AM storage device.
- C: Sider CP/AM storage device.
- D: Sider CP/AM storage device.
- E: Sider CP/AM storage device.
- F: Sider CP/AM storage device.

\*APATCH12 is Applied Engineering's updated version (1.2) of First Class Peripheral's APATCH program.

# Sider Support

## Appendix C

After choosing either option and pressing Return, the program will display this prompt:

**Enter the line (0-127 chars) you wish to execute whenever the operating system is booted.**

Enter the desired command line and press return. Any allowable CP/AM command may be used. If no command line is to be executed, just press the Return key. After the command line is entered, the message, "PRESS RETURN TO RE-BOOT SYSTEM," will be displayed. Press Return and the program will re-boot the CP/AM 5.1 operating system using the startup defaults you selected.

### Step 3. Copying command files to the boot drive.

If option 2 was selected, only one file needs to be copied from the CP/AM 5.1 System Master to the A: (boot) volume. In order to return to the Sider Main Menu from CP/AM without having to completely re-boot, the command file AEXIT.COM must be present on the A: volume.

If option 1 was selected, you may use the PIP command to copy files from the CP/AM 5.1 System Master to the Sider's A: volume. Make sure to copy the file AEXIT.COM to the A: volume.

Whenever you wish to exit the CP/AM environment and return to the Sider Main Menu, type: AEXIT<cr> at the A> prompt. If you wish, AEXIT.COM can be renamed using the REN system command.

**IMPORTANT!** If the configuration of the computer is ever changed in any way, such as adding, deleting, moving any peripheral cards, or mounting or dismounting any CP/AM volumes on the Sider, the operating system CP/AM startup defaults must be reset as described above.

Note to MegDrive users: For users with an Applied Engineering RamWorks memory expansion card installed in their Apple //e, the MEGDRIVE.COM file will create an emulated disk drive using the extra memory on the RamWorks card. When creating a CP/AM MEGDRIVE, the MEGDRIVE command, when used without a drive specifier, emulates volume C:. To avoid conflicts with other devices, assign the MEGDRIVE an unused drive specifier. For example, the command, MEGDRIVE G:, will create an emulated volume G: or will change the specifier of your current MegDrive to G: and will not conflict with volumes A: through F:.



## Further Reading

### *Appendix D*

#### Further Reading

These books are available at most bookstores.

The CP/M Handbook by Rodney Zaks \*  
Published by Sybex Inc.  
2344 6th Street, Dept. A  
Berkeley, California 94710  
1-800-227-2346

Introduction to Wordstar by Arthur Naiman \*  
Published by Sybex Inc.  
2344 6th Street, Dept. A  
Berkeley California 94710  
1-800-227-2346

Microsoft BASIC \*  
Published by Dilithium Press  
11000 S.W. 11th Street Suite E  
Beaverton, OR 97005  
(503) 646-2713

dBASE II users guide  
Published by Green/Prentice-Hall

Programming the Z-80 by Rodney Zaks  
Published by Sybex Inc.  
2344 6th Street, Dept. A  
Berkeley, California 94710  
1-800-227-2346

How to Get Started With CP/M by Carl Townsend  
Published by Dilithium Press  
P.O. Box 606  
Beaverton, Oregon 97005

CP/M Assembly Language Programming by Ken Barbier  
Published by Prentice-Hall, Inc.  
Englewood Cliffs, New Jersey 07632

Z-80 Programming and Interfacing  
Published by Howard Sams, Inc.  
4300 West 62nd Street  
Indianapolis, Indiana 46268

\*Highly recommended





